UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/762,771	01/22/2004	Said Al-Hallaj	IIT-187	3107

42419 7590 11/06/2006

PAULEY PETERSEN & ERICKSON
2800 WEST HIGGINS ROAD
SUITE 365
HOFFMAN ESTATES, IL 60195

EXAMINER	
WANG, EUGENIA	

ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 11/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/762,771	AL-HALLAJ ET AL.	
	Examiner	Art Unit	
	Eugenia Wang	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☒ Claim(s) *14-18, 20, 22, and 24-26* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *1/22/04* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *8/05/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement filed August 5, 2004 has been placed in the application file and the information referred to therein has been considered as to the merits.

Drawings

2. Figure 2 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). It is the same as figure 1, discussed in US 6,365,290. Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: [200], the hybrid system mentioned in figure 6 (p 20, line 5). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the

filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

4. The disclosure is objected to because of the following informalities: "be" in line 1 of page 21 is a typographical error and should be removed so that it reads 'are replaced' rather than "are be replaced."

Appropriate correction is required.

Claim Objections

5. Claims 14-17, and 24-26 objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The aforementioned claims are inherently part of a fuel cell as mentioned in independent claims 1 (as applied to 14-17) and 21 (as applied to claims 24-26).

Fuel Cell Handbook describes a fuel cell in their technology overview: Fuel cells are electrochemical devices that converts the chemical energy of a reaction directly into electrical energy (as applied to claims 14 and 24) (p 1-1, lines 1-2). The basic physical structure of a fuel cell consists of an electrolyte layer in contact with a porous anode and cathode on either side (as applied to claims 15, 16, 25, and 26) (p 1-1, lines 2-3).

Additionally, in a typical fuel cell, gaseous fuels are fed continuously to the anode (negative electrode) and an oxidant is fed continuously to the cathode (positive electrode) compartment; the electrochemical reactions take place at the electrodes to produce an electric current (as applied to claim 17) (p 1-1, lines 7-10). See figure 1-1 for further details.

6. Claims 18, 20, and 22 are objected to because of the following informalities:

a. With respect to claim 18, the claim recites an extraneous "of" in line 2 of the claim;

b. With respect to claim 20, the claim uses "and" to mark a choice between internal reforming and external reforming, where the alternative 'or' should be used.

c. Claim 22 is objected to because it is missing a comma between the word "cells" and "molten" in line 3 of the claim.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1-6, 14, 21-24 are rejected under 35 U.S.C. 102(b) as being anticipated by "A new water and power combination: Vacuum vapor compression seawater distillation and natural gas fuel cells" (Campbell et al.).

As to claims 1, 2, 3 and 21 Campbell et al. teach an alternative to conventional desalination systems that are dependent on abundant oil; in their case they have designed an ultra efficient vacuum vapor compression distillation (VVCD) system for the production of fresh water from seawater (seawater as applied to claim 2 and VVCD as applied to claim 3) (p 423, lines 2-9). Additionally, this system is ideal with coupling with a variety of alternative energy sources, especially fuel cells, because they not only produce electricity, but they also produce waste heat in the form of hot water and air that can be used to increase the efficiency of the integrated system (p 423, lines 9-15). As can be seen by figure 1, the TEM (total energy module) fuel cell system provides power (DC) to the VVCD system. Additionally, freshwater and brine outputs indicate a successful desalination. Running the system as previously described also performs the method for generating electricity and desalinating salinous water, which comprises of the steps generating electricity with a fuel cell and powering the desalination system with electricity from the fuel cell to produce fresh water from the salinous water, as specified by claim 1.

As to claim 4-6, Campbell et al. teach that fuel cells have two by-products: hot water and thermal energy. In Campbell et al.'s combined fuel cell desalination system, the hot water (a form of thermal exhaust emitted from the fuel cell) is used to heat the incoming feed seawater, while the thermal energy is used to reduce radiant losses from

the distillation system (p 424, lines 30-31). This heated water is then used to produce the fresh water. See figure 1 for further details. Additionally the seawater is heated by the hot water via a heat exchanger, as the thermodynamic process starts with the seawater coming in contact with a heat exchanger (as applied to claim 5) (p 430, lines 28-29, figure 2). Part of the seawater is turned into saturated vapor, which enters the compressor; afterwards the vapor is sent into the condenser, where it is condensed into liquid freshwater (as applied to claim 6) (p 431, lines 2-7).

As to claims 14 and 24, Campbell et al. teach that a fuel cell runs a reaction that forms water from hydrogen and oxygen, which liberates energy (p 441, lines 17-18). The fuel cell converts chemical energy into electric current (p 441, lines 20-21).

As to claim 22, Campbell et al. mentions proton-exchange membrane fuel cells and phosphoric acid fuel cells for their uses in stationary/vehicular and propulsion system power generation, respectively (p 441, lines 4-10).

As to claim 23, Campbell et al. teach a combined fuel cell desalination system where the hot water is used to heat the incoming feed seawater, while the thermal energy is used to reduce radiant losses from the distillation system (p 424, lines 30-31). This heated water is then used to produce the fresh water. See figure 1 for further details. Additionally the seawater is heated by the hot water via a heat exchanger, as the thermodynamic process starts with the seawater coming in contact with a heat exchanger (as applied to claim 5) (p 430, lines 28-29, figure 2). Part of the seawater is turned into saturated vapor, which enters the compressor; afterwards the vapor is sent

into the condenser, where it is condensed into liquid freshwater (as applied to claim 6) (p 431, lines 2-7).

8. Claims 1-6, 11, 12, 21-23, and 27 is rejected under 35 U.S.C. 102(e) as being anticipated by US Patent Publication 2003/0132097 (Kenet et al.).

As to claims 1 and 21, Kenet et al. teach a fuel-cell powered desalination device. This device includes a saltwater input line [12], a desalinator (connected to the input as well as having a fresh water output and a brine output) [10], an energy source for the desalinator, a fuel cell connected to the desalinator for generating electricity [70], and a heat exchanger that transfers heat from the fuel cell to the desalinator [90] (as applied to claim 21) (para 0010-0014). Running the system as previously described also performs the method for generating electricity and desalinating salinous water, which comprises of the steps generating electricity with a fuel cell and powering the desalination system with electricity from the fuel cell to produce fresh water from the salinous water, as specified by claim 1.

The teachings of Kenet et al. have been set forth above are herein incorporated.

As to claim 2, Kenet et al. defines saltwater to include any water with salts or other contaminants that are desirable to be removed, mentioning seawater as a particular example (para 0027, lines 1-4).

Regarding claims 3 and 27, a reverse osmosis desalinator can be used as the desalinator of choice (para 0016, lines 1-2).

As to claims 4-6, 11, and 12 Kenet et al. teach operating a fuel cell that generates electricity and waste heat, where the waste heat to heat the desalinator (para

0025). Waste heat generated by the fuel cell [70] is used to heat the desalinator [10] using a heat exchanger [90] by either indirectly by preheating the input saltwater [12] (as applied to claims 4 and 5) or directly at the evaporator (para 0037, lines 1-4). As can be seen in figure 1, fresh water [28] leaves the system, after the heated salinous water is further treated. Additionally, there is a vapor line [26] that passes through a heat exchange section [14], which transfers heat from the vapor line [26] to the evaporator [20]. The vapor line [26] thus condenses and is output as fresh water [28] as desalinated water (as applied to claim 6) (para 0031, lines 14-19). As previously mentioned the desalinator could be a reverse osmosis desalinator (as applied to claim 11) (para 0016, lines 1-2). Additionally, the electricity is said to assit in operating the desalinator (as applied to claim 12) (para 0025, lines 3-5).

Regarding claim 22, the fuel cell that is preferred is a phosphoric-acid fuel cell (para 0017, lines 1-3).

As to claim 23 Kenet et al. teach operating a fuel cell that generates electricity and waste heat, where the waste heat to heat the desalinator (para 0025). Waste heat generated by the fuel cell [70] is used to heat the desalinator [10] using a heat exchanger [90] by either indirectly by preheating the input saltwater [12] (as specified by claim 23) or directly at the evaporator (para 0037, lines 1-4). Figure 1 shows a desalination device using a vapor compression desalinator. Salt water enters through the input line [12] and passes through a heat exchange section [14], where it later passes through an evaporator, thus producing desalinated water vapor (para 0031, lines 1-6). The water vapor then passes through a compressor [24], and the vapor line

[26] is then condensed to produce desalinated water [28] (para 0031, lines 7-19). The seawater that does not evaporate collects as brine in section [16] paragraph 0032, lines 1-2).

9. Claims 14 -17and 24-26 rejected under 35 U.S.C. 102(b) as being anticipated by Campbell et al. or Kenet et al. as evidence by Fuel Cell Handbook.

The teachings of Campbell et al. Kenet et al. have been set forth above and are herein incorporated.

Claims 14-20 and 24-26 include parts that inherently belong to the fuel cell mentioned in independent claims 1 (as applied to 14-17) and 21 (as applied to claims 24-26).

As to claims 14 and 24, Fuel Cell Handbook describes a fuel cell in their technology overview, where a fuel cell is defined as an electrochemical devices that converts the chemical energy of a reaction directly into electrical energy (as a supplement necessary for only the Kenet et. al prior art) (p 1-1, lines 1-2). The basic physical structure of a fuel cell consists of an electrolyte layer in contact with a porous anode and cathode on either side (as applied to claims 15, 16, 25, and 26) (p 1-1, lines 2-3). Additionally, in a typical fuel cell, gaseous fuels are fed continuously to the anode (negative electrode) and an oxidant is fed continuously to the cathode (positive electrode) compartment; the electrochemical reactions take place at the electrodes to produce an electric current (as applied to claim 17) (p 1-1, lines 7-10). See figure 1-1 for further details.

As to claims 18-20, Campbell et al. teach that their TEM fuel cell system can run on many fuels, however the particular teaching focuses on natural gas fired units (as to claims 18 and 19) (p 442, lines 28-31). Additionally, Campbell et al. teach that hydrogen gas can be removed from hydrogen-rich compounds (including methane and methanol) (p 441, lines 34-38). Removing hydrogen from hydrogen-rich compounds inherently includes reforming of the hydrocarbon fuel to do so (as applied to claim 20).

As to claim 18-20, Kenet et al teach the use of hydrogen fuel for the use in a fuel cell, namely a phosphoric-acid cell (as applied to claim 18) (para 0034, lines 1-3). Although a hydrocarbon fuel source is not mentioned, Table 1-1 in Fuel Cell Handbook (p 1-5) shows that external reforming of methane can be used to provide the charge carrier H^+ (as applied to claims 19 and 20). (In this case, methane is taken to be equivalent to natural gas, as natural gas is nearly pure methane in its purest form.)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 11, 12, and 27 rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al..

The teachings of Campbell et al. have been discussed above and are herein incorporated.

Regarding claims 11 12 and 27, Campbell et al. teach a desalination system that is powered by a fuel cell (as applied to claim 12). Additionally, Campbell et al. mentions that the technology most competitive with VVCD is reverse osmosis (RO) and that the costs of RO have steadily declined over the past three decades (p 440, lines 1-4).

The difference between Campbell et al. and claims 11 and 27 is that the heated salinous water (as produced in claim 5 with respect to claim 11) is not being delivered into a reverse osmosis system, which acts as the desalination system. However, as noted above, a RO system can be used for desalination. The motivation for using the mentioned reverse osmosis system is the fact that RO (1) has become more

economical with recent research and (2) requires a small amount of maintenance. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify Campbell et al.'s system by using reverse osmosis rather than VVCD in order to improve economy and to have less mechanical maintenance.

11. Claims 7-10 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Campbell et al. or Kenet et al. in view of US 5346592 (Madani).

The teachings of Campbell et al. and Kenet et al. have been discussed above and are incorporated herein, independent of one another.

The differences between the claims 7-10 and 28 and the teachings of Campbell et al. or Kenet et al. is that neither Campbell et al. nor Kenet et al. teach a fuel cell/desalination system that uses a multi-stage flash distillation system as its mode of desalination (as applied to claims 7, 10, and 28). Claims 8 and 9 outline procedures used by the flash distillation system.

Madani notes that there are two major desalinations classifications: (1) thermal processes or (2) membrane processes (col 1, lines 18-20). The most widely used thermal process uses multistage flash distillation (MSF) (as applied to claim 6 and 28) (col 1, lines 25-26). The process MSF goes through is heating the salt water into a flash chamber the pressure is lowered allowing salt water to boil at lower temperatures (col 1, lines 27-30). The vapor produced is condensed on tubes that carry fresh, cool salt water into the plant (as applied to claims 8 and 9) (col 1, lines 31-32). In the heat exchange process, steam heats the cooler salt water, while the vapor condenses into

desalinated water (as applied to claim 9) (col 1, lines 32-34). (If this desalination system were connected to a fuel cell, then claim 10 would be fulfilled as well. Both Campbell et al. and Kenet et al. teach desalination systems in conjunction with a fuel cell.)

The motivation for using a distillation column is that the distillation column is reusable, which would cut down on machinery costs. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify the desalination systems taught by either Campbell et al. or Kenet et al. in order to have a reusable water desalination system, which would cut down on capital costs.

12. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over either Campbell et al. or Kenet et al. in view of US Patent Publication 2003/0012997 (Hsu).

The teachings of Campbell et al. and Kenet et al. have been discussed above and are herein incorporated.

The difference between either Campbell et al. or Kenet et al. and claim 13 is that neither teach the use of the exhaust energy to heat the salinous water for a period of time and then generate energy exhaust for additional energy for a second period of time.

Hsu teaches an electrochemical converter [72] (e.g. a fuel cell) that has air [13] and fuel [74] introduced to it, where the reactants power the converter (para 0034). The product is electrical power and high temperature exhaust. The exhaust is introduced to the interior of a pressure vessel [77], which collects and routes the exhaust [79] to the

gas turbine expander [80], which converts the thermal energy into rotary energy for subsequent transfer to an electric generator [84] (para 0035, lines 5-10). The electric generator produces electricity (para 0035, lines 10-11). See figure 1 for more details. It is noted that the waste heat can be used for heating as well (a building/facility or a heating component in a boiler) (para 0036, lines7-10; para 0037, lines 1-5). The latter of the two embodiments is similar to Campbell et al.'s and Kenet et al.'s use of the waste heat, which was used to heat the salinous water.

The motivation for using part of the waste heat to generate electricity is to be able to harness that electricity for other uses, for example to power the desalinator or to power other instruments. The added electricity would be especially useful if the fuel cell did not generate the amount of electricity need to run the desalinator or if the amount thermal exhaust produced exceeded the amount needed for heating the seawater. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify the teachings of either Campbell et al. or Kenet et al. in order to produce extra electricity for powering the desalinator or for using thermal energy not used to heat the salt water.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugenia Wang whose telephone number is 571-272-4942. The examiner can normally be reached on 8 - 4:30 Mon. - Fri., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

EW Nov. 1, 2006

GREGG CANTELMO
PRIMARY EXAMINER